Chapter No 5: Processing Data

Difference B/W Data and Information

▶ Data is a collection of facts, while information puts those facts into context. While data is raw and unorganized, information is organized. Data points are individual and sometimes unrelated. Information maps out that data to provide a big-picture view of how it all fits together.

How Computer Represent Data

▶ Computers use bits (binary digits) to represent data as ones and zeroes. Bits are the smallest piece of information a computer can store. Explore how computers use the binary number system to represent numbers, text, images, and sound with electrical signals in their circuits.

Number System

▶ A computer can understand only a few symbols called digits and these symbols describe different values depending on the position they hold in the number. In general, the binary number system is used in computers. However, the octal, decimal and hexadecimal systems are also used sometimes.

Binary System

▶ Binary describes a numbering scheme in which there are only two possible values for each digit -- 0 or 1 -- and is the basis for all binary code used in computing systems. These systems use this code to understand operational instructions and user input and to present a relevant output to the user.

Octal System

▶ Octal refers to the base-8 numbering system. It comes from the Latin word for eight. The octal numbering system uses the numerals 0-1-2-3-4-5-6-7. In computing environments, it is commonly used as a shorter representation of binary numbers by grouping binary digits into threes.

Hexadecimal System

▶ Hexadecimal is a numbering system with base 16. It can be used to represent large numbers with fewer digits. In this system there are 16 symbols or possible digit values from 0 to 9, followed by six alphabetic characters -- A, B, C, D, E and F.

Bits and Bytes

▶ A bit (binary digit) is the smallest unit of data that a computer can process and store. A bit is always in one of two physical states, similar to an on/off light switch.

▶ In most computer systems, a byte is a unit of data that is eight binary digits long. A byte is the unit most computers use to represent a character such as a letter, number or typographic symbol. Each byte can hold a string of bits that need to be used in a larger unit for application purposes.

Text Codes

▶ In computing, a code segment, also known as a text segment or simply as text, is a portion of an object file or the corresponding section of the program's virtual address space that contains executable instructions.

How Computer Process Data

► Data processing, manipulation of data by a computer. It includes the conversion of raw data to machine-readable form, flow of data through the CPU and memory to output devices, and formatting or transformation of output. Any use of computers to perform defined operations on data can be included under data processing.

CPU

► The Central Processing Unit (CPU) is the primary component of a computer that acts as its "control center." The CPU, also referred to as the "central" or "main" processor, is a complex set of electronic circuitry that runs the machine's operating system and apps.

Control Unit

A control unit, or CU, is circuitry within a computer's processor that directs operations. It instructs the memory, logic unit, and both output and input devices of the computer on how to respond to the program's instructions. CPUs and GPUs are examples of devices that use control units.

Arithmetic Logic Unit

► An arithmetic logic unit (ALU) is a digital circuit used to perform arithmetic and logic operations. It represents the fundamental building block of the central processing unit (CPU) of a computer. Modern CPUs contain very powerful and complex ALUs. In addition to ALUs, modern CPUs contain a control unit (CU).

Machine Cycles

Machine cycle is also known as the processor cycle. The Central processing unit (CPU) is the main component for the execution of the machine cycle as it is the main component of the computer system. The main components of the machine cycle are the central processing unit and memory unit

Memory

► Memory is the ability to store and retrieve information when people need it. The four general types of memories are sensory memory, short-term memory, working memory, and long-term memory.

Non-Volatile Memory

► Non-volatile memory is memory that retains its values even when power is removed. Earlier forms of non-volatile memory included various forms of read-only memory (ROM).

Flash Memory

► Flash memory is a long-life and non-volatile storage chip that is widely used in embedded systems. It can keep stored data and information even when the power is off. It can be electrically erased and reprogrammed. Flash memory was developed from EEPROM (electronically erasable programmable read-only memory).

Volatile Memory

► Volatile memory, in contrast to non-volatile memory, is computer memory that requires power to maintain the stored information; it retains its contents while powered on but when the power is

interrupted, the stored data is quickly lost. Volatile memory has several uses including as primary storage.

Register

▶ A register is basically a storage space for units of memory that are used to transfer data for immediate use by the CPU (Central Processing Unit) for data processing. Also known as memory registers, they can actually form part of the computer processor as a processor register

Memory and Computing Power

▶ The amount of memory also determines the amount of virtual CPU available to a function. Adding more memory proportionally increases the amount of CPU, increasing the overall computational power available.

The Computer Internal Clock

▶ Computers use an internal clock to synchronize all of their calculations. The clock ensures that the various circuits inside a computer work together at the same time. Clock speed is measured by how many ticks per second the clock makes.

BUS

▶ A bus, in computing and digital technology, is an electronic pathway through which data can be transferred. This pathway uses signals that move at different speeds and are sent through different channels to communicate information between components within a computer or network.

Data Bus

▶ Data bus is a computer subsystem that facilitates the exchange of information between various components on a motherboard or system board or between separate computers. This involves moving information to and from the system's RAM or the CPU.

Address Bus

An address bus is a computer bus architecture. It is used to transfer data between devices. The devices are identified by the hardware address of the physical memory (the physical address). The address is stored in the form of binary numbers to enable the data bus to access memory storage

Bus Standards

▶ Parallel bus standards include advanced technology attachment (ATA) or small computer system interface (SCSI) for printer or hard drive devices. Serial bus standards include universal serial bus (USB), FireWire or serial ATA with a daisy-chain topology or hub design for devices, keyboards or modem devices.

Cache Memory

▶ Caches are used to store temporary files, using hardware and software components. An example of a hardware cache is a CPU cache. This is a small chunk of memory on the computer's processor used to store basic computer instructions that were recently used or are frequently used.

Processor

▶ A processor (CPU) is the logic circuitry that responds to and processes the basic instructions that drive a computer. The CPU is seen as the main and most crucial integrated circuitry (IC) chip in a computer, as it is responsible for interpreting most of computers commands.

Microcomputer Processor

▶ microcomputer, an electronic device with a microprocessor as its central processing unit (CPU). Microcomputer was formerly a commonly used term for personal computers, particularly any of a class of small digital computers whose CPU is contained on a single integrated semiconductor chip.

Intel Processor

▶ An Intel® processor is a type of microprocessor produced by the Intel Corporation. It is the brain of a computer and is responsible for processing data and instructions.

Advanced Micro Devices Processor

▶ Advanced Micro Devices (AMD) is a semiconductor company, known for designing and developing computer processors and graphics technologies.

Freescale Processor

▶ Freescale Semiconductor offers a premier line of award- winning, high-performance Power PCTM processors for the computing, networking in- fra structure, and telecom- munications applications.

IBM Processor

▶ IBM Power microprocessors (originally POWER prior to Power10) are designed and sold by IBM for servers and supercomputers.[1] The name "POWER" was originally presented as an acronym for "Performance Optimization With Enhanced RISC". The Power line of microprocessors has been used in IBM's RS/6000, AS/400, pSeries, iSeries, System p, System i, and Power Systems lines of servers and supercomputers. They have also been used in data storage devices and workstations by IBM and by other server manufacturers like Bull and Hitachi.

Comparing Processor

▶ To compare CPUs, you can look at various factors such as the number of cores and threads, clock speed, benchmark scores, and overall performance in specific tasks or applications. There are also online CPU comparison tools available that can help you make a more informed decision.

RISC Processor

▶ A Reduced Instruction Set Computer is a type of microprocessor architecture that utilizes a small, highly-optimized set of instructions rather than the highly-specialized set of instructions typically found in other architectures.

Parallel Processing

▶ Parallel computing is a type of computation in which many calculations or processes are carried out simultaneously. Large problems can often be divided into smaller ones, which can then be solved at the same time

Standard Computer Ports

▶ In computer hardware, a port is the jack or receptacle for some other peripheral device to plug into. These are standardized for each purpose. Some common ports are Universal Serial Bus ports, USB-C ports, Ethernet ports or Display Ports.

Serial And Parallel Port

▶ A serial port can transfer a single data stream. At the same time, a parallel port can transfer multiple data streams. The serial port sends data over and over again. Parallel ports send more than one bit at a time.

Specialized Expansion Ports

▶ SCSI

▶ USB

▶ IEEE 1394

▶ Musical Instrument Digital Interface

SCSI

▶ Small Computer System Interface is a set of standards for physically connecting and transferring data between computers and peripheral devices, best known for its use with storage devices such as hard disk drives.

USB

▶ Universal Serial Bus (USB) is an industry standard that allows data exchange and delivery of power between many various types of electronics.

IEEE 1394

▶ IEEE 1394 is an interface standard for a serial bus for high-speed communications and isochronous real-time data transfer. It was developed in the late 1980s and early 1990s by Apple in cooperation with a number of companies, primarily Sony and Panasonic. Wikipedia

▶ Bitrate: 1394a, half-duplex 100–400 Mbit/s (12.5–50 MB/s); 1394b and later, full-duplex 800–3200 Mbit/s (100–400 MB/s)

Musical Instrument Digital Interface

▶ Musical Instrument Digital Interface (MIDI) is a standard to transmit and store music, originally designed for digital music synthesizers. MIDI does not transmit recorded sounds. Instead, it includes musical notes, timings and pitch information, which the receiving device uses to play music from its own sound library.

Expansion Slots And Boards

▶ an expansion slot is a connection or port inside a computer on the motherboard or riser card. It provides an installation point for a hardware expansion card to be connected. For example, if you wanted to install a new video card in the computer, you'd purchase a video expansion card and install that card into the compatible expansion slot.

PC Cards

▶ A PC card, also known as a PCMCIA card, is a credit card-sized memory or input/output (I/O) device that fits into a PC, usually a laptop. Developed by the Personal Computer Memory Card International Association, a PC card adds peripheral capability to a laptop.

Plug And Play

▶ The ability of a computer or device to automatically recognize and configure compatible hardware components without requiring manual intervention or additional software installation.